CLAIMS

I claim:

1. A method of shifting the resonance curves of an optical ring filter using the Kerr effect comprising the steps of:

Coupling an incident optical wave ("W_{inc}") to one of the optical bus waveguides (the "buses") of an optical ring filter comprising two buses coupled to a ring waveguide resonator (the "ring");

Setting the value of the wavelength λ_{inc} of W_{inc} to one of the resonant wavelength values of the ring resulting in W_{inc} propagating through the ring to the other bus;

Increasing the optical intensity of W_{inc}, causing a shift in the refractive index value of the ring due to the Kerr effect, up to a working point where the resonant intensity of W_{inc} remains large enough to maintain the shift of the value of the refractive index of the ring;

Resulting in a shift of the resonance curves of the ring, which are also the resonance curves of the optical ring filter.

2. A method of achieving All-Optical Wavelength Switching with an optical ring filter using the Kerr effect as claimed in claim 1 and comprising the steps of:

Coupling a new optical wave ("W_{new}") with continuous optical intensity into the optical ring filter and setting the value of its wavelength λ_{new} to one of the resonant wavelength values of the ring;

Coupling W_{new} into one of the buses such that W_{new} and the incident optical wave W_{inc} are counter-propagating in the ring;

Modulating the optical intensity of W_{inc} and increasing its average optical intensity so as to induce the Kerr effect and a shift of the resonance curves of the ring;

Varying the shift of the resonance curves by modulating the optical intensity of W_{inc} according to the modulation pattern of W_{inc}, thereby causing a change to the resonance of W_{new} in the ring and, therefore, to the optical intensity of W_{new} at the output port of the bus where W_{new} was initially coupled such that the modulation of the intensity of W_{new} at this port matches the modulation pattern of W_{inc} resulting in an all-optical transfer of the intensity modulation pattern of W_{inc} to W_{new};

Selecting λ_{new} different from λ_{inc} thereby achieving all-optical wavelength conversion also known as all-optical wavelength switching.

3. A method of achieving All-Optical Wavelength Tuning with an optical ring filter using the Kerr effect as claimed in claim 1 and comprising the steps of:

Using a broadband source to produce an incident optical wave W_{inc}, which has a subset of its spectral components matching the band-pass of the ring and therefore being resonant, with the subset being determined by the optical intensity of W_{inc} due to the Kerr effect;

Coupling W_{inc} to one of the buses of the ring and coupling the optical wave to be filtered out by the optical ring filter ("W_{filt}") to one of the buses of the ring such that W_{filt} and W_{inc} are counter-propagating in the ring;

Increasing or decreasing the optical intensity of W_{inc} so as to shift respectively forward or backward the resonance curves of the ring thereby tuning the optical wavelength that W_{filt} must have to be resonant in the ring and to be filtered out by the optical ring filter from one bus to the other bus.

4. A method of achieving All-Optical Wavelength Dropping with an optical ring filter using the Kerr effect as claimed in claim 3 and comprising the steps of:

Coupling a bundle of optical waves ("W_{bund}") to one of the buses where W_{inc} is not initially coupled and in such a way that W_{bund} and W_{inc} are counter-propagating in the ring;

Selecting a spectrum of wavelengths of W_{bund} that is smaller than the free spectral range of the ring;

Tuning the wavelength to be filtered out by the optical ring filter by increasing or decreasing the optical intensity of W_{inc};

Matching the wavelength of W_{filt} to the optical wavelength of the optical wave in the bundle that is desired to be dropped ("W_{drop}"), thereby causing W_{drop} to be resonant in the ring and coupled from one bus to the opposite bus through the ring while the remaining waves of W_{bund} are coupled at the output port of their initial bus resulting in the dropping of the desired optical wave from the bundle of optical waves;

5. A method of achieving All-Optical Wavelength Adding with an optical ring filter using the Kerr effect as claimed in claim 4 and comprising the steps of:

Coupling an optical wave desired to be added ("W_{add}") to W_{bund} to the bus where W_{inc} is initially coupled and in such a way that W_{add} and W_{inc} are counter-propagating in the ring;

Selecting the optical wavelength λ_{add} of W_{add} that is different from each optical wavelength of the optical waves of W_{bund};

Increasing or decreasing the optical intensity of W_{inc} so as to tune the wavelength filtered out by the optical ring filter to match it to the wavelength λ_{add}, thereby causing W_{add} to be resonant in the ring and coupled from its initial bus to the bus where W_{bund} is coupled resulting in the addition of W_{add} to W_{bund} at the output port of this bus.

6. A method of achieving All-Optical Add-and-Drop Multiplexing with an optical ring filter using the Kerr effect by combining the methods claimed in claim 4 and claim 5 in the same optical ring;

7. A method of achieving All-Optical Space Switching using All-Optical Add-and-Drop Multiplexers as claimed in claim 6 and comprising the steps of:

Interconnecting several All-Optical Add-and-Drop Multiplexers in a matrix;

Coupling at each input of the N optical inputs of the matrix a bundle of optical waves;

Adding, dropping or passing each wave of the bundle of optical waves through the add-and-drop multiplexers and coupling said waves to one chosen optical output of the M optical outputs of the matrix achieving, thereby, All-Optical Space Switching.

8. A method of achieving All-Optical Intensity Modulation with an optical ring filter using the Kerr effect as claimed in claim 3 and comprising the steps of:

Coupling the optical wave to be modulated ("W_{mod}") to one of the buses such that W_{mod} and W_{inc} are counter-propagating in the ring;

Tuning the wavelength to be filtered out by the optical ring filter to a point where it matches the optical wavelength λ_{mod} of W_{mod};

Increasing or decreasing the optical intensity of W_{inc} around said point so as to tune the resonance curves over the band-pass of the ring resonator, thereby causing W_{mod} to be more or less resonant and causing part of its intensity to be coupled at the output port of its initial bus resulting in All-Optical Intensity Modulation.